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स्वचल वाहन — एम्पीटर — विशिष्टि  
( तीसरा पुनरीक्षण )

**Automotive Vehicles — Ammeters —  
Specification**  
( *Third Revision* )

ICS 43.040.30

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## FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Electrical Equipments and Instruments Sectional Committee had been approved by the Transport Engineering Division Council.

This standard was first published in 1970 and was revised in 1982 and 2000. In this revision Dust test, Bump test and Salt spray test, have been included.

In preparing this standard, considerable assistance has been derived from JIS D 5604 : 1973 (Re-affirmed in 2010) 'Ammeters for automobiles' published by the Japanese Standards Association.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard*

**AUTOMOTIVE VEHICLES — AMMETERS —**

**SPECIFICATION**

*( Third Revision )*

## 1 SCOPE

**1.1** This standard specifies the design and performance characteristics of moving magnet type ammeters to indicate the rate of charge and discharge of automobile storage batteries including those on trucks and tractors. However, ammeters for motor cycles and scooters are not covered by this standard.

**1.2** In case of ammeter on cluster units the requirements are applicable only for ammeters.

## 2 REFERENCES

The following standards contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below :

<i>IS No.</i>	<i>Title</i>
4905 : 1968	Methods for random sampling
9000	Basic environmental testing procedures for electronic and electrical items:
(Part 2/Sec 3) : 1977	Cold test, Section 3 Cold test for non-heat dissipating items with gradual change of temperature
(Part 3/Sec 3) : 1977	Dry heat test, Section 3 Dry heat test for non-heat dissipating items with gradual change of temperature
(Part 5/Sec 2) : 1981	Damp heat (cyclic) test, Section 2 12+ 12 h cycle
(Part 7/Sec 2) : 1979	Impact test, Section 2 Bump
(Part 7/Sec 3) : 1979	Impact test, Section 3 Drop and topple
(Part 11) : 1983	Salt mist test
(Part 12) : 1981	Dust test
(Part 14/Sec 2) : 1988	Test N: Change of temperature, Section 2 Test Nb : Change of temperature (temperature cycling) with specified rate of change — One chamber method ( <i>first revision</i> )
(Part 16) : 1983	Driving rain test

## 3 TERMINOLOGY

For the purpose of this standard the following definitions shall apply.

**3.1 Effective Range** — That part of the scale where measurements can be made with stated accuracy.

**3.2 Error in Indication** — The difference between the indicated value and the true value of the quantity measured. The error is positive if the indicated value is greater, and negative if it is smaller than the true value.

**3.3 Full Scale Value** — The higher of the value associated with the scale end marks.

**3.4 Scale Division** — Interval between two successive scale marks.

**3.5 Scale Length** — The length of the arc measured between two extreme end marks of the scale along the bottom of the short scale marks over which the pointer shall traverse.

**3.6 Scale Mark** — A number of marks by which it is possible to register the position of the pointer of the instrument.

**3.7 Scale Range** — The number of units indicated on the scale between the two end marks of the scale.

**3.8 Type Tests** — Tests carried out to prove conformity with the specification. These are intended to prove the general qualities and design of a given type of ammeter.

**3.9 Acceptance Tests** — Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

**3.10 Routine Tests** — Tests carried out on each ammeter to check requirements which are likely to vary during production.

## 4 DESIGN AND CONSTRUCTION

### 4.1 Graduation

While facing the dial, the right hand side, in principle, shall be the charged side and the left hand side shall be discharge side. The unit of graduation shall be ampere (A). The terminals on the reverse side shall be marked '+L' and '+B' in order to indicate the charging condition when current flows from '+L' to '+B'.

#### 4.1.1 Preferred ranges shall be as given below:

- 15 A to +15 A
- 30 A to +30 A
- 50 A to +50 A
- 60 A to +60 A
- 80 A to +80 A

#### 4.2 Terminals

Studs or bolts projecting out of the housing to which connections are made shall be completely insulated from the housing. The terminals shall be made of brass only.

#### 4.3 Illumination

The instrument shall be made with or without arrangements for illumination, as per the requirement of the purchaser.

#### 4.4 Mounting

The mounting arrangement shall be such as to facilitate its fixing from the front side by clamping it with a suitable nut and bracket arrangement.

### 5 DIMENSIONS

The diameter of the case or housing shall either be 52 mm or 60 mm. All other dimensions including those of the mounting accessories shall be as shown in Fig. 1. This does not apply to non-circular ammeters and ammeters used on clusters.

## 6 TESTS

### 6.1 Classification of Tests

#### 6.1.1 Type Tests

The following shall constitute type tests :

- a) Visual examination (see 6.2),
- b) Accuracy test (see 6.3),
- c) High voltage (flash) test (see 6.4),

- d) Continuous load test (see 6.5),
- e) Overload test (see 6.6),
- f) Vibration test (see 6.7),
- g) Cold test (see 6.8),
- h) Dry heat test (see 6.9),
- j) Damp heat (cycling) test (see 6.10),
- k) Drop test (see 6.11),
- m) Rapid change of temperature test (see 6.12),
- n) Water spray test (see 6.13),
- p) Dust test (see 6.14),
- q) Bump test (see 6.15),
- r) Salt spray test (see 6.16), and
- s) Endurance test (see 6.17).

#### 6.1.1.1 Criteria for approval

Ten samples shall be submitted together with the relevant data. These shall be tested according to the test sequence of tests given in Annex A. The testing authority shall issue a type approval certificate if the ammeters are found to comply with the requirements of tests given in 6.1.1.

#### 6.1.1.2 Provision for repeat tests

In case of failure in one or more type tests, the testing authority may call for fresh samples not exceeding twice the number of original samples and subject them to test(s) in which failure occurred. If in repeat test(s) no failure occurs, the tests may be considered to have been satisfactory.

#### 6.1.2 Acceptance Tests

The following shall constitute acceptance tests:

- a) Visual examination (see 6.2),
- b) Accuracy test (see 6.3), and
- c) High voltage (flash) test (see 6.4).

**6.1.2.1.** The number of samples for acceptance shall be as agreed by the manufacturer and the purchaser. However, a recommended plan of sampling is given in Annex B.

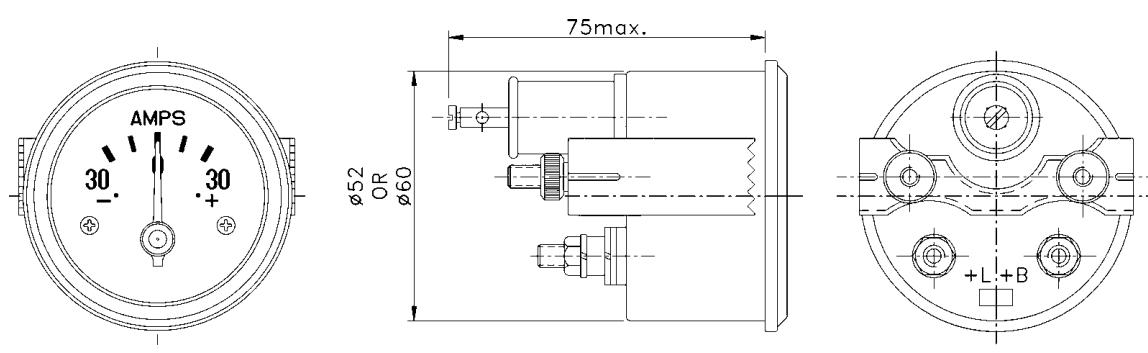


FIG. 1 MOUNTING DIMENSIONS FOR AMMETER

### 6.1.3 Routine Test

The following shall constitute routine tests:

- a) Visual examination (see 6.2),
- b) Accuracy test (see 6.3), and
- c) High voltage (flash) test (see 6.4).

### 6.2 Visual Examination

The external components as well as dial shall be visually examined for surface defects. The dial characteristics colour, styling and printing shall be subject to the agreement between the manufacturer and the purchaser.

### 6.3 Accuracy Test

#### 6.3.1 Initial Error

When no current flows, the permissible variation shall be  $\pm 2$  percent of the full scale deflection from the zero position.

#### 6.3.2 Tolerance on Indication

Tolerance for every indicated value falling within the effective range shall be within  $\pm 7$  percent of the full scale value or  $\pm 2$  A, whichever is greater, when measured at  $25 \pm 5^\circ\text{C}$ .

#### 6.3.3 Damping

When the current is cut off from the position of two thirds of the full scale value, the pointer shall come to zero and be standstill within 3 s at a position, depending on the initial error as indicated in 6.3.1.

#### 6.3.4 Overshoot

When the instrument is energized to indicate a particular value, the overshoot shall not exceed the final steady deflection of the particular value by more than 20 percent of the full scale deflection.

#### 6.3.5 Instrument Angle

The accuracy test shall be checked keeping the instruments angle as fitted in the vehicle.

### 6.4 High Voltage (Flash) Test

The ammeter shall be subjected to a flash test at 500 V ac rms at a convenient frequency of 40 to 60 Hz between each of the terminals and the cover. It shall satisfactorily withstand this test without arcing or puncture.

### 6.5 Continuous Load Test

The ammeter shall withstand a full scale current for a period of 30 min each in charge and discharge direction side, there shall be no damage. After the test, the ammeter shall also satisfy the requirements specified

in 6.3.2. The permissible variation in the observed value shall be  $\pm 2$  A of the initial value

### 6.6 Overload Test

When the instrument is subjected to overload test by applying twice the full load value for maximum of 1s, there shall be no damage. After the test, the ammeter shall also satisfy the requirements specified in 6.3.2. The permissible variation in the observed value shall be  $\pm 2$  A of the initial value.

### 6.7 Vibration Test

The ammeter after being rigidly mounted on a suitable vibrating machine constructed to produce simple harmonic motion shall be subjected to vibration (a total lift of 0.7 mm) through a frequency range of 10-55-10 Hz in a period of 1 min. With continuously varying frequencies the vibration shall be applied for not less than 1 h in each of the three major axes of the ammeter. At the end of the vibration test the ammeter shall be examined for any evidence of the damage and shall be subjected to high voltage (flash) test (6.4). After the test, the ammeter shall also satisfy the requirements specified in 6.3.2. The permissible variation in the observed value shall be  $\pm 2$  A of the initial value.

### 6.8 Cold Test

This test shall be carried out according to IS 9000 (Part 2/Sec 3), with a gradual change in temperature under the following conditions:

Temperature  $-10 \pm 3^\circ\text{C}$

Duration of exposure 2 h

After the test, the ammeter shall satisfy requirements specified in 6.3.2. The permissible variation in the observed value shall be  $\pm 2$  A of the initial value.

### 6.9 Dry Heat Test

This test shall be carried out according to IS 9000 (Part 3/Sec 3), with gradual change of temperature under the following conditions:

Temperature  $+70^\circ\text{C} \pm 3^\circ\text{C}$

Duration of exposure 4 h

After the test, the ammeter shall satisfy the requirements specified in 6.3.2. The permissible variation of the observed value shall be  $\pm 2$  A of the initial value.

### 6.10 Damp Heat (Cycling) Test

This test shall be carried out according to IS 9000 (Part 5/Sec 2). The number of conditioning cycles shall be two. After the test, the ammeter shall satisfy the requirements specified in 6.3.2. The permissible variation of the observed value shall be  $\pm 2$  A of the

initial value.

### 6.11 Drop Test

This test shall be conducted as specified in IS 9000 (Part 7/Sec 3). The test conditions shall be as given below:

- a) Number of drops 6
- b) Drop height 25 mm

After the test, the ammeter shall satisfy the requirements specified in 6.3.2. The permissible variation in the observed value shall be  $\pm 2$  A of the initial value.

### 6.12 Rapid Change of Temperature Test

This test shall be carried out as per IS 9000 (Part 14/Sec 2). The Ammeter shall be exposed to the following conditions :

- Cold temperature, *Min*  $-10 \pm 3^\circ\text{C}$
- Hot temperature, *Max*  $+70 \pm 3^\circ\text{C}$
- Number of cycles 2
- Duration ( $t_1$ ) 30 min

After the test, the ammeter shall satisfy the requirements specified in 6.3.2. The permissible variation in the observed value shall be  $\pm 2$  A of the initial value.

### 6.13 Water Spray Test

The ammeter shall be subjected to this test as specified in IS 9000 (Part 16), exposing only the front parts for 2 h. All ports or openings shall be suitably sealed, except in case of waterproof ammeters. After the test, the ammeter shall satisfy the requirements specified in 6.3.2 and 6.4. The permissible variation in the observed value shall be  $\pm 2$  A of the initial value.

### 6.14 Dust Test

The ammeter shall be subjected to this test as specified in IS 9000 (Part 12) for 5 h. All ports or openings shall be suitably sealed, except in case of dustproof

ammeters. After the test, the ammeter shall satisfy the requirements specified in 6.3.2. The permissible variation in the observed value shall be  $\pm 2$  A of the initial value.

### 6.15 Bump Test

This test shall be conducted as specified in IS 9000 (Part 7/Sec 2). The test conditions shall be as given below:

- a) Number of bumps  $4000 \pm 10$
- b) Acceleration  $400 \text{ m/s}^2$
- c) Pulse duration 6 ms

After the test, the ammeter shall satisfy the requirements specified in 6.3.2. The permissible variation in the observed value shall be  $\pm 2$  A of the initial value.

### 6.16 Salt Spray Test

This test shall be conducted as specified in IS 9000 (Part 11) for 50 h consisting of two periods, each period being of 24 h of spraying and 1h draining. After the test, the ammeter shall satisfy the requirements specified in 6.3.2. The permissible variation in the observed value shall be  $\pm 2$  A of the initial value. The visual appearance of the gauge after the test shall not prejudice assessment of results.

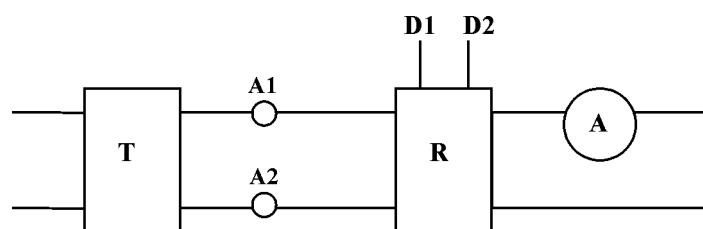
### 6.17 Endurance Test

#### 6.17.1 Test Rig

The test rig used for the endurance test for ammeter shall be as given in Fig. 2.

#### 6.17.2 Cycle

A current of full scale reading of the ammeter is passed through the instrument, resulting in full scale deflection in the positive direction and then it is switched off. Again the current is reversed for a full scale deflection in the negative direction and switched off. This constitutes a complete cycle.



NOTE — *T* is a timer operating a reversing relay through its coil terminals *A*<sub>1</sub> and *A*<sub>2</sub>. *D*<sub>1</sub> and *D*<sub>2</sub> are the supply terminals of a suitable DC source for passing the current through the ammeter under test. The current through the ammeter should be adjustable.

FIG. 2 TEST RIG FOR ENDURANCE TEST

### 6.17.3 Number of Cycles

The ammeter shall be operated continuously for 1 00 000 cycles at the rate of 20 cycles per min and examined for undue wear or breakage of components.

### 6.17.4 Acceptance Criteria

After the test, the ammeter shall satisfy the requirements specified in 6.3.2. The permissible variation in the observed value shall be  $\pm 2$  A of the initial value.

## 7 MARKING

**7.1** The ammeter shall be marked with the following :

- a) Indication of the source of manufacture or trade-mark or both;

- b) Country of manufacturer, if preferred by the purchaser;
- c) Month and year of manufacture;
- d) The symbol for the quantity measured; and
- e) + L and + B for the terminals.

**7.1.1** The ammeters may also be marked with the BIS Standard Mark

**7.1.2** The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made there under. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

## ANNEX A

(Clause 6.1.1.1)

### SEQUENCE OF TESTS FOR TYPE APPROVAL

Test	Sequence									
	1	2	3	4	5	6	7	8	9	10
Visual examination (see 6.2)	X	X	X	X	X	X	X	X	X	X
Accuracy test (see 6.3)	X	X	X	X	X	X	X	X	X	X
High voltage (flash) test (see 6.4)	X	X	X	X	X	X	X	X	X	X
Continuous load test (see 6.5)	X									
Overload test (see 6.6)		X								
Vibration test (see 6.7)			X							
Cold test (see 6.8)				X						
Dry heat test (see 6.9)					X					
Damp heat (cycling) test (see 6.10)						X				
Drop test (see 6.11)							X			
Rapid change of temperature test (see 6.12)								X		
Water spray test (see 6.13)									X	
Dust Test (see 6.14)										X
Bump Test (see 6.15)										X
Salt Spray Test (see 6.16)										X
Endurance test (see 6.17)										X X

NOTE — X—Sample to be tested.

**ANNEX B**  
*(Clause 6.1.2.1)*  
**RECOMMENDED SAMPLING PLAN FOR ACCEPTANCE TESTS**

**B-1 LOT**

**B-1.1** In a consignment, the ammeters of the same type and rating and manufactured under similar conditions of production in the same factory shall be grouped together to constitute a lot.

**B-1.2** The number of ammeters to be selected from each lot shall depend upon the size of the lot and shall be in accordance with col 1 and 2 of Table 1.

**B-1.2.1** The ammeter shall be selected from the lot at random. In order to ensure the randomness of selection, procedures given in IS 4905 may be followed.

**B-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY**

All ammeters selected from the lot at random according to col 1 and 2 of Table 1 shall be subjected to the

acceptance tests. An ammeter failing to meet the requirements of any of the acceptance tests shall be termed as defective. The lot shall be considered as conforming to the requirements of the acceptance tests if the number of defectives is less than or equal to corresponding acceptance number given in col 3 of Table 1; otherwise the lot shall be rejected.

**Table 1 Sample Size and Acceptance Number***(Clauses B-1.2 and B-2)*

Lot Size (1)	Sample Size (2)	Acceptance Number (3)
Up to 100	8	0
101 to 300	13	0
301 to 500	20	1
501 to 1 000	32	2
1 001 and above	50	3

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### **Amendments Issued Since Publication**

Amend No.	Date of Issue	Text Affected

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